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KLARQUIST SPARKMAN, LLP
121 S.W. SALMON STREET, SUITE #1600
ONE WORLD TRADE CENTER
PORTLAND, OR 97204-2988

EXAMINER	
SOUW, BERNARD E	
ART UNIT	**PAPER NUMBER**
2881	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	10/070,675	WAYNANT, RONALD W
	Examiner	Art Unit
	Bernard E Souw	2881

-- The MAILING DATE of this communication app ars on the cover she t with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE ____ MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *02/19/2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20 and 22-38* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20 and 22-38* is/are rejected.

7)☒ Claim(s) *1-20 and 22-38* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Preliminary Amendment

1. The Amendment and Remarks filed 02/19/2004, in response to the first Office Action dated 09/30/2003 has been entered. The present Office Action is made with all the suggested amendments being fully considered.

Claim 21 has been cancelled and new claims 27-38 have been added.

Accordingly, claims 1-20 and 22-38 are pending in this Office Action.

Claim Rejections - 35 USC § 112 – 2nd paragraph

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 18 and 23, and hence, also claims 19, 20, 22 and 24-26 dependent thereof, are rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 18 and 23 recite an "*object image*" (in line 5 of both claims) generated by a first pulse portion after an electromagnetic pulse source is splitted by a beam splitter into a first and a second pulse portions. It is not clear in claims 18 and 23, whether the "*object image*" is formed in the optical wavelength range (i.e., including visible, infrared and ultraviolet wavelengths) or in the X-ray wavelength range.

Interpreted in light of the specification, pg. 6/ll.6-7, reciting a variety of lasers such as Ti:sapphire, Nd:YAG and Cr:LiSAF lasers as being the electromagnetic pulse source, the first pulse portion --and consequently the "*object image*"-- must be inherently of optical wavelengths to be distinguished from X-ray wavelengths, as generally known in the art. However, this contradicts the specification on pg.7/ll.9-16, which implicates that the image is an X-ray image, i.e., in the X-ray wavelength range, whereas on pg.7/ll.17-18 it is again implicated that the final image is in the optical wavelength range (luminescence light, line 18).

In order to proceed with this Office Action, the "*object image*" is assumed to be an optical image, i.e., in the visible (VIS), ultraviolet (UV) or infrared (IR) wavelength ranges. This is a straight-forward interpretation in light of the specification, as derived from the wavelength output of the Ti:sapphire, Nd:YAG and Cr:LiSAF lasers recited in the specification. The assumption is further supported by Applicant's amended limitation of EIT (electromagnetically induced transparency), which is known in the art as being an effect sofar observed only in the optical wavelength range, but never in the X-ray wavelength range, as described in more details in the next claim rejections under 35 U.S.C. §101 and §112, first paragraph.

Note, this new ground of rejection based on 35 U.S.C. 112, second paragraph, is solely necessitated by Applicant's amendment of claims 18 and 23, reciting EIT and microchannel plate (MCP) detector, the EIT being known as an effect within the optical wavelength range, whereas the new added limitation of MCP is known in the art as being a detector sensitive to UV and X-rays, thus referring back to pg.7/ll.9-16

implicating the image being an X-ray image. There was no such ambiguity in the original claim: the first pulse portion, and hence, the "*object image*", can have no other possibility than being in the VIS/UV/IR range, since there is no implication of X-ray whatsoever, neither an MCP nor an X-ray source or generator.

However, in the event Applicant disagrees with the Examiner's determination regarding the ambiguity or indefiniteness of claims 18 and 23, thereby denying his own specification especially regarding laser types and beam splitters, claims 18 and 23 would be subsequently rejected under 35 U.S.C. §101 and §112, first paragraph, as applied in this Office Action to claims 1, 10, 27 and 33 (see next sections).

Claim Rejections - 35 USC § 112 – 1st paragraph

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1, 6, 10, 18, 23, 27, 28 and 33, and consequently claims 2-5, 7-9, 11-17, 19, 20, 22, 24-26, 29-32 and 34-38 dependent thereof, are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter that was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Claims 1, 6, 10, 18, 23, 27, 28 and 33 recite the limitation of (a) an electromagnetic pulse source of optical wavelengths (i.e., visible (VIS), ultraviolet (UV)

or infrared (IR) wavelengths), as stated on pg. 6/ll.6-7, reciting a variety of lasers such as Ti:sapphire, Nd:YAG and Cr:LiSAF lasers; (b) a beam splitter splitting said optical pulse of VIS/UV/IR wavelengths into a first and a second pulse portions, meaning that both portions are inherently of optical wavelengths, as well; (c) an X-ray source generating a beam in response to the first pulse portion, the generated beam being in the X-ray wavelength range, as disclosed in the specification pg.7/ll.2-5 & ll.9-13, the X-ray beam generating an X-ray object image, as unambiguously recited in claim 1/ll.6 & 7, claim 10/ll.5 & 6, claim 27/ll.6 & 7, and claim 33/ll.5 & 6.

However, these limitations stand in direct conflict with the next limitation of (d) "*an X-ray time gate .... in response to the second pulse portion*", the second pulse portion being of optical wavelengths, i.e., <u>in the event Applicant would insist the X-ray time gating is accomplished by the EIT effect induced by (or in response to) the second pulse portion, the latter being inherently in the optical wavelength range</u>. This EIT-based time-gating is rejected under 35 U.S.C. 112, first paragraph, for at least the following reasons:

(a) There is no evidence whatsoever that Ta and Mo are capable of exhibiting EIT effect recited in the specification, pg.8 line 18. In the contrary, there is plenty of evidence that Ta and Mo, being pure metals, are never capable of any EIT effect for their lack of discrete atomic energy levels required for exhibiting the effect (see, e.g., Bajcsy et al., Letters to Nature, Vol. 426, 2003, pp. 638-641, esp. referring to Fig.1a; and Andrew Merriam in OE magazine, May 2001, referring to Fig. 1). Instead of being discrete, the electron energy levels in metal conductors such as Ta and Mo are quasi-continuous

while being all filled-up until a portion of the conduction band, having a maximum value corresponding to its respective work function, as generally known in the art (see, e.g., R. Nave, http://hyperphysics.phy-astr.gsu.edu/hbase/solids/band.html#c6/, under "Conductor Energy Bands"). As well known in the art, in order to exhibit the EIT effect a material must have at least three discrete energy levels serving as terminal levels for a coupling/pumping beam and a probe beam, the former for preparing the atomic system, the latter undergoing the EIT effect. This fact is evidenced by ***all*** references on EIT (without a single exception) available in the open literature; see, e.g., Bajcsy et al. and Merriam, for EIT in gas cells, as recited above, and Yamamoto'720. (USPAT # 5,898,720), for EIT in semiconductor quantum wells, referring to Figs. 14A & 14B to 16A & 16B. It is to be noted, Yamamoto'720 also describe EIT energy levels in gases and semiconductors, but not a single example of metal conductors such as Ta and Mo.

Note, only as ***impurities*** (i.e., in minute concentrations) in a solid insulating and optically transparent material are metallic elements such as Ta and Mo *potentially* capable to provide appropriate energy levels that would enable EIT, as disclosed by Yamamoto et al. in Col.5/ll.52-55, Col.6/ll.7-17 and ll.35-40, the optically transparent solid material being recited in Col.5-line 52 and Col.6/ll.35-36. However, in no instance can pure metal conductors such as Ta and Mo be capable of EIT, for reasons already stated above. In the event Applicant would traverse this rejection, Applicant is required to provide a hard evidence in compliance of MPEP §2107.02/V.

[MPEP §2107.02/V: "In appropriate situations the Office may require an applicant to substantiate an asserted utility for a claimed invention. See In re Pottier, 376 F.2d

328, 330, 153 USPQ 407,408 (CCPA 1967) ("When the operativeness of any process would be deemed unlikely by one of ordinary skill in the art, it is not improper for the examiner to call for evidence of operativeness."). See also In re Jolles, 628 F.2d 1322, 1327, 206 USPQ 885, 890 (CCPA 1980); In re Citron, 325 F.2d 248, 139 USPQ 516 (CCPA 1963); In re Novak, 306 F.2d 924, 928, 134 USPQ 335, 337 (CCPA1962). In In re Citron, the court held that when an "alleged utility appears to be incredible in the light of the knowledge of the art, or factually misleading, applicant must establish the asserted utility by acceptable proof." 325 F.2d at 253, 139 USPQ at 520"].

(b) There is no evidence whatsoever that any EIT has ever been observed with X-ray beam, let alone that the hypothetical X-ray EIT being gateable by (i.e., in response to) a light beam of optical wavelengths, as recited in Applicant's claims.

(c) Being pure metals, both Ta and Mo are inherently opaque for optical wavelengths, and hence, can not possibly allow the second pulse portion penetrate the material to act as a coupling or pump beam, since the second pulse portion is unambiguously of optical wavelengths.

The direct conflict between claim limitations (a), (b) and (c) with claim limitation (d), as described above, unambiguously demonstrates that the claims contain subject matter that is not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Furthermore, in the event Applicant disagrees with the Examiner's determination or assumption regarding the indefiniteness of claims 18 and 23 under the previous 35 U.S.C. 112, second paragraph, thereby denying his own specification, claims 18 and 23 will inevitably be also rejected under 35 U.S.C. 112, first paragraph over the same reasons as applied to claims 1, 6, 10, 18, 23, 27, 28 and 33 above.

Note, the only way to avoid the above 35 U.S.C. 112, first paragraph, rejection is to interpret the last claim limitation, (d) "*an X-ray time gate .... in response to the second pulse portion*", as not being due to EIT effect --let alone using Ta or Mo as EIT medium-- as described in the specification, but instead, by any other means plausible and well known to one of ordinary skill in the art, e.g., by a tricky method disclosed by Hagelstein et al. (USPAT # 4,873,439). However, such an acceptable interpretation is only applicable to claims 1, 10, 27, and 33, i.e., claims that do not specifically recite the word "*EIT*". The other claims, i.e., claims 6, 18, 23, 28, and all the claims dependent thereof, remain rejected under the above 35 U.S.C. 112, first paragraph, for reciting the word "EIT" which is deemed incredible in the light of knowledge in the art (see next).

Claim Rejections - 35 USC § 101 and § 112 – 1st paragraph

35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

4. Claims 6, 18, 23, 28, and consequently all the claims dependent thereof, are rejected under 35 U.S.C. 101 because the claimed invention is not supported by either a credible asserted utility or a well established utility.

Claims 6, 18, 23 and 28 recite the limitation (d) "*an X-ray time gate .... in response to the second pulse portion*". Interpreted in light of the specification, i.e., specifically on pg. 8/ll.15-31, a time-gating of an X-ray detector such as MCP by an EIT effect in response to a VIS/UV/IR light pulse produced by a variety of lasers such as Ti:sapphire, Nd:LYAG and Cr:LiSAF lasers, as recited on pg. 6/ll.6-7, must be deemed *incredible in the light of the knowledge of the art,* because there is no such thing known in the art –at least until today--, whereas Applicant's disclosure on pg.8/ll.15-31 involving Ta and Mo as EIT materials is inconsistent with known scientific principles regarding the type of energy levels required for EIT.

[<u>MPEP §2107.01/II</u> (underlines added by the examiner): "the Office considered the asserted utility to be inconsistent with known scientific principles or "<u>speculative at best</u>" as to whether attributes of the invention necessary to impart the asserted utility were actually present in the invention. In re Sichert, 566 F.2d 1154, 196 USPQ 209 (CCPA 1977)."].

A *prima facie* showing for the incredibility of Applicant's invention is based on the following facts:

(a) There is no evidence whatsoever that Ta and Mo are capable of exhibiting EIT effect as disclosed in the specification, pg.8 line 18. In the contrary, there is plenty of evidence that Ta and Mo, being pure metal conductors, are never capable of any EIT

effect for their lack of discrete atomic energy levels required for exhibiting the effect (see, e.g., (a) Bajcsy et al., Letters to Nature, Vol. 426, 2003, pp. 638-641, esp. referring to Fig.1a; (b) Andrew Merriam in OE magazine, May 2001, referring to Fig. 1; (c) Hau et al. Lett. to Nature 397, 1999, 594-598, referring to Fig. 1; and (d) Harris, Physics Today July 1997, referring to Figs. 2 -3). Instead of being discrete, the electron energy levels in metal conductors such as Ta and Mo are quasi-continuous, while being all filled up until a portion of the conduction band, having a maximum value corresponding to its respective work function, as generally known in the art (see, e.g., (e) R. Nave, under "Conductor Energy Bands"; (f) Dekker, "Solid State Physics", Ch. 10-5, pg. 251, referring to Fig. 10-7; (g) Sze, Physics of Semiconductor Devices, p. 251, referring to Fig.4, work function of metals, inlc. Ta and Mo). As well known in the art, in order to exhibit the EIT effect, a material must have at least three discrete energy levels serving as terminal levels for a coupling/pumping beam and a probe beam, the former for preparing the atomic system, the latter undergoing the EIT effect. This fact is evidenced by ***all*** references on EIT (without a single exception) available in the open literature; see, e.g., ref. (a)-(g) recited above, and Yamamoto'720 (USPAT # 5,898,720), for EIT in semiconductor quantum wells, in reference of Figs. 14A & 14B to 16A & 16B. It is to be noted, Yamamoto'720 describe EIT energy levels in gases and semiconductor quantum wells, but not a single example of metal conductors such as Ta and Mo.

Note, only as ***impurities*** (i.e., in minute concentrations) in a solid insulating and optically transparent material are metallic elements such as Ta and Mo *potentially* capable to provide appropriate energy levels that would enable EIT, as disclosed by

Yamamoto'720 in Col.5/ll.52-55, Col.6/ll.7-17 and ll.35-40, as already recited previously. However, in no instance can pure metal conductors such as Ta and Mo be capable of EIT, for reasons already stated above. In the event Applicant would traverse this rejection (and persist with the claim that Ta and Mo is capable to serve as EIT material), Applicant is required to provide a hard evidence in compliance of MPEP §2107.02/V (see previous MPEP citation).

(b) There is no evidence whatsoever that any EIT has ever been observed with X-ray beam, let alone that the hypothetical X-ray EIT being gateable by light beam of optical wavelengths, as recited in Applicant's claims. Again, in the event Applicant would traverse this rejection (and insist to claim that EIT has been observed in X-ray wavelength region), Applicant is required to provide a hard evidence in compliance of MPEP §2107.02/V (see previous MPEP citation).

(c) Being pure metals, both Ta and Mo are inherently opaque for optical wavelengths, and hence, can not possibly be gated by the second pulse portion, the latter being unambiguously of optical wavelengths. Again, in the event Applicant would traverse this rejection (and persist with the claim that Ta and Mo is transmissive for optical wavelengths, hence, to the second pulse portion), Applicant is required to provide a hard evidence in compliance of MPEP §2107.02/V (see previous MPEP citation).

(d) MCP is conventionally gated by a voltage pulse, as disclosed by Eckart et al. (Rev. Sci. Instrum. 57 (9), 1986, pp. 2046-2048). In this regard, a time-resolved capture of X-ray image in response to an optical light pulse is disclosed by Hagelstein et al. (USPAT 4,873,349), however, in a fully different manner than Applicant's disclosure, pg. 8/ll.15-

31. Since Applicant's claim has been deemed *prima facie* incredible, in the event Applicant would persist with the claim of being able to gate an MCP X-ray detector by an optical light pulse by virtue of the EIT effect, as disclosed on pg.8/ll.15-31, Applicant is required to provide a hard evidence in compliance of MPEP §2107.02/V (see previous MPEP citation), i.e., a working MCP detector that is optically time-gateable by the EIT effect induced in a film deposited on the MCP surface.

5. Claims 6, 18, 23, 28, and consequently all the claims dependent thereof, are also rejected under 35 U.S.C. 112, first paragraph. Specifically, since the claimed invention is not supported by either a credible asserted utility or a well established utility for the reasons set forth above, one skilled in the art clearly would not know how to use the claimed invention.

6. Note, all the above recited new grounds of rejections have been solely necessitated by Applicant's amendment of the respective claims, especially the recitations of "X-ray time gate", "X-ray object image", "EIT", and microchannel plate (MCP) detector.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 18-20, 22, 23, and 25-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over McLean (XP-002154943) in view of Ham et al. (J. Opt. Soc. Am. B 16 (5), 1999, pp. 801-804):

► Regarding claims 18-20, McLean discloses an imaging apparatus & method, comprising:

- an electromagnetic (EM) pulse source (=laser), as recited in the Abstract/ll.1-2;
- a beam splitter as recited in the Abstract/ll.1-2, splitting a pulse from the EM pulse source into a first and second portion, the first portion directed toward an object (46) for generating an object image; and
- a microchannel plate (MCP) detector that simultaneously acts as a time-gate for capturing the object image in response to the second pulse portion (=gate pulse), as recited in the Abstract/ll.8-10.

However, McLean does not teach the use of a film of gating material exhibiting EIT and situated to transmit the object image to the MCP detector in response to the second pulse portion. This limitation is taught by Ham et al., showing in Fig.1 a film gating material (Pr:YSO) exhibiting EIT and situated to transmit the object image (probe beam in Ham's Fig.1) in response to the second pulse portion (coupling beam in Ham's Fig.1), as recited in Ham's Abstract and on pg.802 section 3, "Experimental Setup".

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a film gating material Pr:YSO exhibiting EIT to transmit McLean's object image (equivalent to Ham's probe beam in Fig.1) in response to the second optical pulse portion, instead of using a conventional electronic gate pulse to

switch-on the MCP, since an optical gate is potentially much more precise than an electronic gate, both regarding the gate length as well as the gate jitter, as generally known in the art, as taught by Ham in section 1, Introduction.

Note, in the above rejected claims 18-20, 22, 23, and 25-26, the first and second pulse portions as well as the object image are all of optical wavelengths. Should the Applicant attempts to interpret or amend the claims so as to implicate an X-ray object image, the limitation of X-ray time-gating using EIT effect would be inevitably rejected under 35 U.S.C. §101 and §112, first paragraph, as applied previously in this Office Action.

9. Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over McLean in view of Ham et al., and further in view of Hirose et al. (USPAT 5,680,429).

McLean as modified by Ham et al. recites all the limitations of claim 24, as previously applied to claim 23, except the recitation of generating an image beam in response to the first pulse portion by directing the first pulse portion to an X-ray source.

Hirose et al. disclose in Fig.5 an X-ray source that can be produced by irradiating laser beam 7 on a target 1, as recited in Col.9/ll.65-67 & Col.10/ll.1-11. McLean's first portion of the laser beam can here be used (after appropriate second or third harmonic generation, as generally known in the art) in place of Hirose's laser beam 7 to generate a laser-produced-plasma X-ray to be directed onto object, thereby producing object image in the optical wavelengths due to X-ray luminescence or fluorescence, as

generally known in the art. This optical image is then detected by McLean MCP detector, which is also known in the art as being sensitive to visible light.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use laser-generated Hirose's X-ray to make an image of an object, since an X-ray is known to have deep penetration capability, so a 3-D image can thus be generated.

10. Claims 1, 2, 4, 5, 7, 9-15, 27, 29, 30, 32-34, 37 and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Alfano'368 in view of Hirose et al. (USPAT 5,680,429) and Hagelstein et al. (USPAT 4,873,439).

Alfano'368 discloses in Fig.3 and recited in Col.5/ll.35-64 an imaging apparatus & method comprising:

- an EM pulse source (=laser) 33;
- a beam splitter splitting a pulse from the EM pulse source 33 into a first (labeled 1054 nm) and second portion (labeled 527 nm), the first portion directed toward an object (46) for generating an object image.

However, Afano'368 does not recite using an X-ray source generating a beam in response to the first pulse portion, the beam directed toward an object for generating an X-ray object image

Hirose et al. disclose in Fig.5 an X-ray source that can be produced by irradiating laser beam 7 on a target 1, as recited in Col.9/ll.65-67 & Col.10/ll.1-11. Alfano'368's first portion of the laser beam labeled 1054 nm can here be used (after appropriate

second or third harmonic generation, as generally known in the art) as Hirose's laser beam 7 to generate a laser-produced-plasma X-ray for imaging Alfano'368's object in Fig.3 as an X-ray object image, i.e., by placing Hirose's laser beam 7 between Alfano'368's beam splitter and the object (diffusive media in Fig.3)..

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use laser-generated Hirose's X-ray to make an image of an object, since an X-ray is known to have deep penetration capability, so a 3-D image can thus be generated.

However, Alfano'368 as modified by Hirose et al. does not recite the limitation of an X-ray time gate capturing the X-ray object image in response to the second pulse portion. This limitation is rendered obvious by Hagelstein et al., as shown in Figs. 4-6 and recited in Col.5/ll.40-68 and Col.6/ll.1-11. More specifically, Alfano's Kerr cell in Fig.3 is replaced by Hagelstein's Multiple Quantum Well (MQW) structure 50 shown in Fig.4 as a time-gate. Hirose's X-ray from Fig.5 illuminates Alfano's object in Fig.3, and generates an X-ray image represented by Hagelstein's incident X-rays 52 shown in Fig.4, which is time-gated by the MQW gate structure 50 to be recorded by an image detector as recited by Hirose in Col.9/ll.13-17, teaching that Alfano's CCD detector 37 in Fig.3 and/or Hagelstein's CCD camera 46 in Fig.4 can be functionally replaced by an MCP as recited in the present claim(s). Note, although Hagelstein's image beam 42 is in the optical wavelength range, the image is a true replica of the X-ray object beam 52.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use Hagelstein's method of time-gating an X-ray object image, in

order to exclude multiple scattering from the recorded image, so as to obtain a clear image despite the multiple scattering by a diffuse media, as taught by Alfano et al. in the Abstract.

► Specifically regarding claim 5, Hirose's target for producing the laser-produced-plasma X-ray is made of Molybdenum, as recited in Col.9/ll.1-5.

► Specifically regarding claim 15, the excellent capabilities of X-rays for 3-D imaging of human tissues, including bones and inner organs, are well known in the art.

► Claims 9, 29, 30, 34, 37 and 38 recite limitations that are inherent in Alfano'368 as modified by Hirose et al. and Hagelstein et al.

11. Claims 3 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Alfano'368 in view of Hirose et al. and Hagelstein et al., and further in view of Biswal (USPAT 5,757,839).

Alfano'368 as modified by Hirose et al. and Hagelstein et al. shows all the limitations of claim 3, as previously applied to the parent claim 2, except a laser pulse width of about 10-30 fs and a laser pulse energy of at least 125-250 mJ at a rate of about 100-250 pulses per second.

The recited laser parameters are conventional for a state-of-the-art Nd:YAG laser, as disclosed by Biswal et al. in Col.12/ll.35-46.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a state-of-the-art but conventional Nd:YAG laser to substitute Alfano'368's laser in order to produce a laser-produced-plasma X-ray as

taught by Hirose, since Biswal's state-of-the-art laser is not only powerful enough but also has a very narrow pulse width in the sub-picosecond order of magnitude appropriate for fast time-gating purposes that is capable of excluding X-ray scattered from the object and built the image only from ballistic X-rays, such that image noise can be significantly suppressed.

12. Claims 6, 28, 35 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Alfano'368 in view of Hirose et al. and Hagelstein et al., and further in view of Ham et al..

Alfano'368 as modified by Hirose et al. and Hagelstein et al. shows all the limitations of claims 6, 28, 35 and 36, as previously applied to the parent claims 1 and 27, except the recitation of an X-ray time gate comprising a film that exhibits EIT in response to the second pulse portion. This limitation is taught by Ham et al., showing in Fig.1 a film gating material (Pr:YSO) exhibiting EIT and situated to transmit the object image (probe beam in Ham's Fig.1) in response to the second pulse portion (coupling beam in Ham's Fig.1), as recited in Ham's Abstract and on pg.802 section 3, "Experimental Setup".

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a film gating material Pr:YSO exhibiting EIT to transmit McLean's object image (equivalent to Ham's probe beam in Fig.1) in response to the second optical pulse portion, instead of using a conventional electronic gate pulse to switch-on the MCP, since an optical gate is potentially much more precise than an

electronic gate, both regarding the gate length as well as the gate jitter, as generally known in the art, as taught by Ham in section 1, Introduction.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to replace Alfano'368's ICDD camera 37 in Fig.3 with a triggerable MCP detector as taught by Hirose et al. in Col.9/ll.13-17, teaching that Alfano's CCD detector 37 in Fig.3 and/or Hagelstein's CCD camera 46 in Fig.4 can be functionally replaced by an MCP as recited in the present claim(s), since an MCP detector is more appropriate (i.e., more sensitive) for use in X-ray wavelength region.

13. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Alfano'368 in view of Hirose et al. and Hagelstein et al., and further in view of Duncan et al. (Optics Letters 16 (23), 1991, pp.1868-1870).

Alfano'368 as modified by Hirose et al. and Hagelstein et al. shows all the limitations of claim 3, as previously applied to the parent claim 2, except the recitation of a Raman amplifier and/or generator to generate the X-ray beam.

Duncan et al. disclose in Fig.1 on pg. 1869 a Raman generator that produces Stokes components of a Nd:YAG laser beam, as recited on pg.1869, ¶.2.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use Duncan's Raman generator to generate Stokes component of Hirose's X-ray (of course with appropriate modifications to accommodate Raman conversion in the X-ray regime, which is well known in the art), since the Raman Anti-Stokes component from the same generator can then be used to reconstruct the

desired image in a second Raman amplifier in a time-gated manner, this second Raman amplifier thus acting as time-gateable image capturer capable of selecting ballistic image photons and exclude the scattered photons by appropriate time delay.

14. Claims 16 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Alfano'368 in view of Hirose et al. and Hagelstein et al., and further in view of Klaveness et al. (USPAT 6,159,445), hereafter denoted as Klaveness'445.

Alfano'368 as modified by Hirose et al. and Hagelstein et al. shows all the limitations of claims 16 and 17, as previously applied to the parent claim 10, except the recitation of a using a contrast agent. Klaveness'445 discloses the use of an X-ray imaging contrast agent, as recited in the Abstract and in Col.1/ll.17-25.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use X-ray imaging contrast agent for in-vivo imaging of human tissues as taught by Klaveness'445, in order to enhance the X-ray images of soft tissues that are normally of poor-contrasts, and thus, improve the medical diagnostic process.

The remaining limitations of claim 16 and those of claim 17 (capturing a second image and comparing with the first) are essentially a duplication of the previously rejected limitations regarding a single image, without any new or unexpected results, and furthermore, involve only routine skills in the art. Therefore, claims 16 and 17 are rejected as previously applied to the parent claim 10, however, with Klaveness'445 as an additional prior art.

Final Rejection

15. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office Action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Response to Applicant's Arguments

15. Applicant's arguments filed on 02/19/2004 have been fully considered but they are moot, because of the new grounds of rejections raised in this Office Action.

Communications

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Bernard E Souw whose telephone number is 703 305

0149. The examiner can normally be reached on Monday thru Friday, 9:00 am to 5:00 pm..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John R Lee can be reached on 703 308 4116. The fax phone numbers for the organization where this application or proceeding is assigned are 703 872 9318 for regular communications and 703 872 9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703 308 0956.

bes
May 05, 2004

JOHN R. LEE
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800